Discovering the Fundamental Theorem of Calculus

Objective: Given a function $\mathbf{y = f(t)}$, find an "area function" $\mathbf{A(x)}$, defined to be $A(x)=\int_a^x f(t)dt$ which represents the area "under" **f** from **t=a** to **t=x**.

Instructions: Complete steps **a** through **d** below for the given functions and intervals.

a. Make a sketch of the function $\mathbf{y = f(t)}$ and shade the region on the interval given.

b. Use a <u>geometric formula</u> to find the area of the shaded region. Your answer should be a function of x and, in fact, be $A(x)=\int_a^x f(t)dt$. If necessary, simplify your answer by multiplying the terms.

c. Check your answer (function) by graphing. Enter into Y1, **Y1=fnInt(F(T) , T, a , x)** and into Y2, your answer for **A(x)**. If the two graphs are <u>not</u> the same curve, find your mistake and regraph.

d. Record your answer on this worksheet.

Examples: 1. $f(t) = 5$ on $[0, x]$. $A(x)=\int_0^x 5dt =$ ________________

2. $f(t) = t$ on $[2, x]$. $A(x)=\int_2^x t\,dt =$ ________________

Problems: 3. $f(t) = 3$ on $[-1, x.]$ $A(x)=\int_{-1}^x 3dt =$ ________________

4. $f(t) = t+3$ on $[0, x]$. $A(x)=\int_0^x (t+3)dt =$ ________________

5. $f(t) = 4t$ on $[0, x]$. $A(x)=\int_0^x 4t\,dt =$ ________________

6. $f(t) = 4t$ on $[1, x]$. $A(x)=\int_1^x 4t\,dt =$ ________________

7. $f(t) = 2t + 3$ on $[0, x]$. $A(x)=\int_0^x (2t+3)dt =$ ________________

8. $f(t) = 2t + 3$ on $[-1, x]$. $A(x)=\int_{-1}^x (2t+3)dt =$ ________________

9. $f(t) = -3t + 7$ on $[-2, x]$ $A(x)=\int_{-2}^x (-3t+7)dt =$ ________________

10. $f(t) = -3t + 7$ on $[1, x]$ $A(x)=\int_1^x (-3t+7)dt =$ ________________

Conjecture: What is the relationship between the "area function" **A(x)** and the original function **f(t)**?

____

____

____